National Aeronautics
and
Space Administration

SIM-Lite Architecture & Performance

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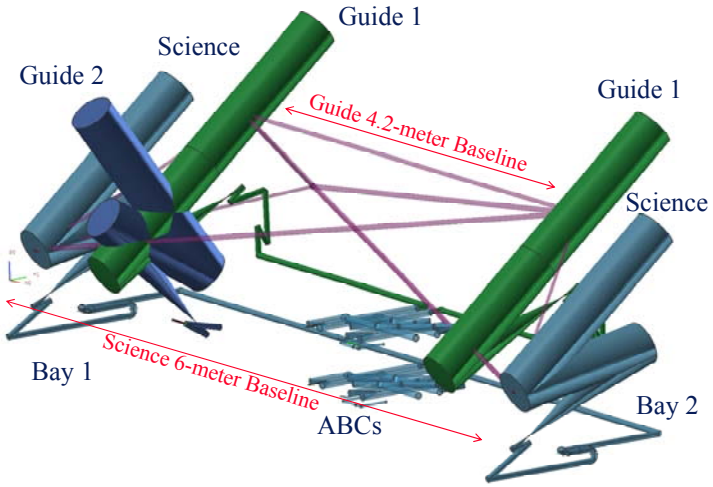
SIM-Lite – Objectives

SIM-Lite is a new concept for a space borne astrometric mission. It will be located in a solar Earth-trailing orbit. SIM-Lite utilized technology developed for the Space Interferometry Mission PlanetQuest. The instrument consists of two Michelson stellar interferometers and a telescope. The first interferometer chops between the target star and a set of reference stars. The second interferometer monitors the attitude of the instrument in the direction of the target star. The telescope monitors the attitude of the instrument in the other two directions.

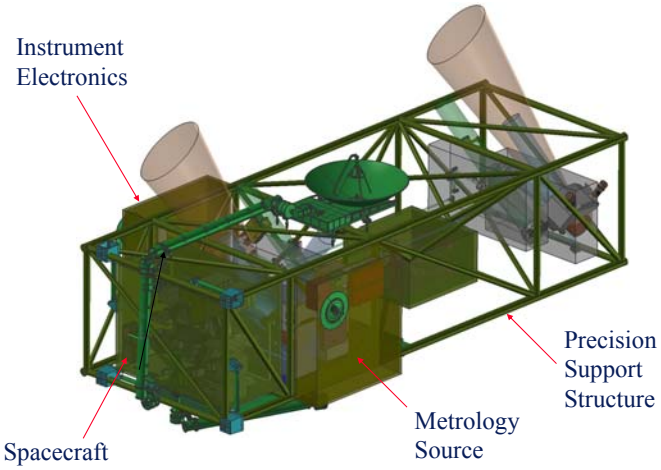
SIM-Lite – Predicted Performance

SIM-Lite will be capable of one micro-arc-second narrow angle astrometry per visit, over a two-degree field of regard for magnitude 6 and brighter target stars. During the 5-year mission, SIM-Lite would search about 60 nearby Sun-like stars for planets of mass down to one Earth mass, in the Habitable Zone. SIM-Lite will also perform global astrometry on a variety of astrophysics objects, reaching 4 micro-arc-second absolute position and parallax measurement accuracy on objects brighter than 15th visual magnitude. As a pointed instrument, SIM-Lite will be capable of achieving 8 micro-arc-second astrometric accuracy on 19th visual magnitude objects and 10 micro-arc-second astrometric accuracy on 20th visual magnitude objects.

SIM-Lite – Optical Prescription

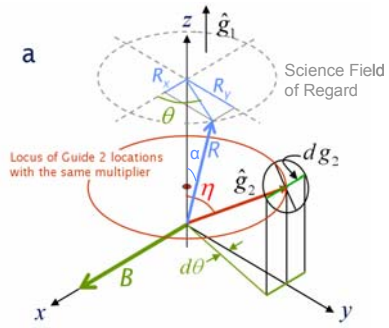


SIM-Lite – Flight Configuration



Guide 2 Telescope Multiplier

- "Guide 2" must track θ, the rotation of the interferometric baseline B around the Guide 1 star. M_{G2} is the Guide 2 multiplier for a Science field of regard (of radius α), centered around the Guide 1 star.



$$M_{G2} = \frac{1}{\sin\eta} \cdot \frac{4}{3\pi} \alpha_{Science}$$

- For an angle η ~ 90° between the Guide 2 and Guide 1 stars and a Narrow Angle science field of regard radius α ~ 1°, the Guide 2 multiplier is 0.0074.
- A 0.4μas sub-allocation to the Guide 2 Telescope of the 1 μas NA astrometric error corresponds to a 54 micro-arcsecond Guide 2 angle tracker.

SIM-Lite – Mission allocation

Task	Targets	Mission
Tier 1 (1Earth)	65 stars	46%
Tier 2	1050 stars	5%
Young Stars	67 stars	2%
Grid	44,000 tiles	9%
Quasars	50 quasars	1.5%
Wide Angle	8,300 hours	19%
S/C Slewing	61,100 slews	14%
Alignment/Cal	50 min/day	3.5%
Total	5 years	100 %

Benefits to NASA and JPL

Although SIM-Lite will not produce the amount of science that SIM PlanetQuest would, a large portion of it, arguably 50%, could be achieved. On the other hand, SIM-Lite (with a cost below $1B) will be a more affordable mission in which NASA can invest in the next few years.